167519

FIVE-YEAR REVIEW REPORT

OTT/STORY/CORDOVA SUPERFUND SITE

MUSKEGON COUNTY, DALTON TOWNSHIP,
MUSKEGON, MICHIGAN

Pursuant to CERCLA
42 U.S.C., Section 9621

Prepared by:
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Region 5
Chicago, Illinois

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9/19/02
Date

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I. EXECUTIVE SUMMARY AND FIVE YEAR REVIEW SUMMARY FORM

The O.U. #1 / O.U. #2 remedy for the Ott/Story/Cordova Superfund site in Muskegon, Michigan is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through pump and treat technology, which is now expected to require no less than 28 more years to achieve. In the interim, groundwater exposure pathways that could result in unacceptable risks are being controlled with groundwater containment through extraction, and the removal of contaminated soil performed as O.U. #3 remedy work. Institutional control in the form of a deed restriction for industrial / commercial use is being implemented by the property owner. Except for operation and maintenance (O&M), long-term monitoring, and recording of restrictive covenants, O.U. #3 remedy work was certified complete in March 2002. All threats at the site have been addressed through: removal of contaminated soil, continued capture and extraction of contaminated groundwater before reaching Little Bear Creek and its unnamed tributary, and treatment of that contaminated groundwater in a groundwater treatment facility. The site achieved construction completion with the signing of the Preliminary Close Out Report on May 1, 2002. The triggering action for this five-year review is the first Five Year Review Report of August 13, 1997. The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the Records of Decision. One amendment to the Operable Unit (O.U.) #3 Record of Decision was issued to reflect reasonably anticipated future land use of the site and incorporate revised State of Michigan cleanup criteria.

SITE IDENTIFICATION		
Site name: OTT/STORY/CORDOVA		
EPA ID: MID060174240		
Region: 5	**State: MI**	**City/County:** MUSKEGON / MUSKEGON COUNTY
SITE STATUS		
NPL status: X Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction X Operating ☐ Complete		
Multiple OUs?* X YES ☐ NO	**Construction completion date:** _05_/_01_/2002	
Has site been put into reuse? ☐ YES X NO		
REVIEW STATUS		
Lead agency: X EPA ☐ State ☐ Tribe ☐ Other Federal Agency		
Author name: JOHN V. FAGIOLO		
Author title: REMEDIAL PROJECT MGR.	**Author affiliation:** U.S. EPA SUPERFUND	
Review period:** _06_/_30_/_2002___ to _09_/_30_/_2002_		
Date(s) of site inspection: _07_/_25_/_2002_ (MONTHLY SITE VISIT)		

Type of review:

X Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

Review number: ☐ 1 (first) X 2 (second) ☐ 3 (third) ☐ Other ~~(specify)~~

Triggering action:

☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____
☐ Construction Completion X Previous Five-Year Review Report
☐ ~~Other (specify)~~

Triggering action date ***(from WasteLAN)***: _08 / _13 / _1997_

Due date ***(five years after triggering action date)***: _09 / 30 / _2002

Issues: O.U. #1 and O.U. #2 remedy should be re-assessed due to ARAR changes, no cleanup standards identified in RODs, decrease in contaminants, and annual remedy cost information. Re-development issues from current and future owners of the site property. Possible cost sharing or operators agreement for the GWTF. Pump and treat optimization recommendations that require additional capital construction funds.

Recommendations and Follow-up Actions: A remedy decision document, either a ROD Amendment or ESD, for the O.U. #1 / O.U. #2 remedy should be developed and issued by U.S. EPA and MDEQ. Site property can be re-developed in accordance with the reasonable future land use established by MDEQ (industrial use). Eventual agreement to drastically reduce or eliminate GWTF costs and allow the non-potable use of treated water by the eventual user of the site property. If such an agreement is not developed, U.S. EPA and MDEQ will implement optimization recommendations to the pump and treat remedy, in concert with adjustment of the remedy's goals. An approximate schedule for implementation of these recommendations is shown in Table 11.

Protectiveness Statement(s): The O.U. #1 / O.U. #2 remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through pump and treat technology, which is now expected to require no less than 28 more years to achieve. In the interim, groundwater exposure pathways that could result in unacceptable risks are being controlled with groundwater containment through extraction, and the removal of contaminated soil. Nearby residents are not using groundwater for potable uses. The O.U. #3 remedy was certified complete in March 2002 after contaminated soil was removed from the site and excavated areas replaced with clean soil. Institutional control in the form of a deed restriction for industrial / commercial use is being implemented by the property owner. A continued presence by U.S. EPA's operations contractor provides security for site property, even though the threat posed by contaminated soil has been removed. All threats at the site have been addressed through: removal of contaminated soil, continued capture and extraction of contaminated groundwater before reaching Little Bear Creek and its unnamed tributary, and treatment of that contaminated groundwater in the GWTF. Long term protectiveness of the remedial action is continually being verified by LTRA and O&M monitoring, and current data indicates groundwater containment is successful and contaminant levels are dropping. Sampling and analysis is ongoing and data indicates that these dropping levels confirm an eventual achievement of remedy goals.

Other Comments:

II. INTRODUCTION

The United States Environmental Protection Agency (U.S. EPA) conducted this statutory review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 121(c), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), the National Contingency Plan (NCP) Section 300.400(f)(4)(ii), and OSWER Directives 9355.7-02 (dated May 23, 1991), 9355.7-02A (dated July 26, 1994), and 9355.7-03B-P (dated June 2001). The purpose of a statutory five-year review is to evaluate whether a completed remedial action remains protective of human health and the environment at sites where hazardous waste remains on-site at levels that do not allow for unlimited use and unrestricted exposure. Because the Ott/Story/Cordova Superfund Site (the "site") is a site at which construction has been completed but regular activity continues through continuing response work (groundwater pump and treat), the detail level presented in this report is appropriate. This Five Year review covers all three Operable Units (O.U.'s) at the site: O.U.#1 which addressed containment of contaminated groundwater, O.U. #2 which addresses additional groundwater containment and treatment of captured groundwater, and O.U. #3 which addresses contaminated soils and sediment. This review and supporting documentation will become part of the site record and copies will be placed in the Administrative Record and local repository for the Ott/Story/Cordova Superfund site in Muskegon, Michigan. This Five Year Review Report has been prepared by the U.S. EPA Remedial Project Manager using U.S. EPA project documents and information supplied by U.S. EPA's contractor, Black and Veatch (BV), by the U.S. Army Corps of Engineers (USACE), and with consultation by the Michigan Department of Environmental Quality (MDEQ). This is the second Five Year Review. The triggering action is the first Five Year Review of August 13, 1997.

III. SITE CHRONOLOGY

Aug., 1982	Hazard Ranking System (HRS) assessment conducted by U.S. EPA.
Sept., 1982	Ott/Story/Cordova site included on the National Priorities List (NPL).
Sept., 1989	RI/FS completed.
Sept. 29, 1989	O.U. #1 ROD signed by U.S. EPA Regional Administrator.
Mar. 3, 1990	O.U. #1 ROD affirmed by U.S. EPA Regional Administrator after re-opening of the ROD and public comment period.
Sept. 29, 1990	O.U. #2 ROD signed by U.S. EPA Regional Administrator.
Feb., 1991	Remedial Design (RD) of O.U. #2 GWTF started by USACE.
Aug. 27, 1991	Western District Court rules in favor of U.S. EPA.
Sept., 1991	Notice to proceed given to USACE for negotiation of access easements for extraction well installation.
Sept. 29, 1992	U.S. EPA Region 5 receives $250,000 settlement from Dr. Ott.
May 10, 1993	U.S. EPA terminates Administrative Orders and proceeds with remedy.
Sept. 23, 1993	O.U. #3 ROD for Low Temperature Thermal Desorption (LTTD) signed by U.S. EPA Regional Administrator.
Oct., 1993	GWTF design completed and construction started.

Apr., 1995	Extraction well installation started.
May, 1995	LTTD remedy design completed and construction started.
July, 1995	U.S. EPA directs USACE to stop O.U. #3 LTTD work because of recommendations by Potentially Responsible Parties (PRPs).
July 14, 1995	U.S. Sixth Circuit Court rules in favor of PRPs.
Sept., 1995	Extraction well installation and development completed.
Feb. 2, 1996	GWTF begins treating contaminated groundwater.
June, 1996	GWTF start-up problems require extension of construction and shakedown contract. Documents for funding approvals initiated.
Sept., 1996	General contractor completes on-site leak testing of GWTF process equipment as required by USACE.
Feb., 1997	Funding for extension of shakedown period is approved by Region 5 Regional Administrator.
May 13, 1997	U.S. Sixth Circuit Court rules in favor of PRPs.
June, 1997	Extraction well fouling and reduced operation due to site hydrogeology prevents full flow of groundwater to GWTF. Limited capacity through GWTF prevents testing at full flow. Decision is made to develop and initiate extraction well preventive maintenance, cleaning, and repair program and extend construction and shakedown contract. Documents for funding approval initiated.
Aug. 13, 1997	Five Year Review (Type Ia) completed by U.S. EPA.
Aug. 22, 1997	U.S. EPA and MDEQ (the "Agencies") perform first informal GWTF walk-through 18 months after commencement of water treatment. Extraction well repair and cleaning continues.
Sept., 1997	IAG amendment is approved by Region 5 Regional Administrator.
Feb. 26, 1998	O.U. #3 ROD Amendment approved by Region 5 Superfund Division.
March, 1998	After performing an analysis and considering all alternatives to alleviate GWTF flow problem, a decision is made that construction of a new, 3 mile larger treated water effluent pipe line is necessary. Documents for IAG Amendment initiated.
May, 1998	Negotiations with property owners (including municipalities and railroad) to obtain access easements for new effluent pipe line construction begin.
June 8, 1998	U.S. Supreme Court rules in favor of U.S. EPA.
Oct. 22, 1998	U.S. EPA and MDEQ perform second informal GWTF walk-through.
Jan., 1999	Easement and property access issues for effluent pipe line construction are resolved.
March, 1999	Notice to proceed is given for construction of new effluent line.
April 14, 1999	Consent Decree is signed by U.S. EPA that requires Aerojet / Cordova to complete the amended O.U. #3 remedy.
Aug. 11, 1999	Start-up of new, larger 3 mile treated water effluent pipe line.
Aug. 9, 2000	U.S. EPA and MDEQ concur to declare the O.U. #1 O.U.#2 GWTF operational and functional.

Feb., 2001	MDEQ approves Final Design for O.U. #3 building demolition and soil excavation, and proceeds with contract bidding procedures.
Oct., 2001	Contractor mobilizes for O.U. #3 building demolition and soil excavation.
Nov. 9, 2001	U.S. District Court in Grand Rapids, MI found the remaining viable PRP not liable on all counts.
Mar., 2002	Pre-Final Inspection of O.U. #3 areas (Areas F, G, R certified complete).
May 1, 2002	Preliminary Closeout Report Signed by Superfund Division Director.

IV. BACKGROUND

IV.A. Site Physical Characteristics

The Ott/Story/Cordova site (the "site") consists of approximately 120 acres generally located at 500 Agard Road in Section 32, Township 11 North, Range 16 West, Dalton Township, Muskegon County, Michigan (see Figures 1 and 2). The site has been divided into three operable units (see Figures 3 and 4): O.U. #1 is the groundwater extraction system intended to protect the Creek; O.U. #2 is a continuation of O.U.#1 and requires restoration of the groundwater aquifer including construction of a groundwater treatment facility (GWTF) to treat extracted groundwater; and O.U.#3 is contaminated soil within the former plant area.

IV.B. Site Description, Land and Resource Use

The site is a former specialty organic chemical production facility that operated under a series of owners from 1957 until 1985. The disposal of both industrial wastewaters and residuals from chemical production in unlined seepage lagoons resulted in contamination of: an aquifer below and downgradient of the site, site soils, and nearby Little Bear Creek (the "Creek") and its unnamed tributary. If not contained, the contaminated groundwater discharges into the Creek system (located about one mile southeast of the site), contributing to degradation of this surface water body. Residences in the immediate area of the site are connected to the local public water system and groundwater is not used for potable uses. Little Bear Creek is a designated trout stream and a tributary to Bear Creek.

IV.C. Site History

A number of companies manufactured chemicals at the site for approximately 30 years. From 1957 to 1972, the Ott Chemical Company owned and operated the site. In 1965, a subsidiary of CPC International (later known as Best Foods, and since purchased by Unilever Inc.), owned and operated the site. From 1972 to 1977, Story Chemical Co. owned and operated the site until Story filed for bankruptcy in 1976. From 1977 to the present, the site has been owned and operated by Cordova Chemical Company of Michigan and Cordova Chemical Company of California, both of which are wholly owned subsidiaries of Aerojet-General.

The former chemical plant area of the site occupies approximately 20 acres. Site contamination includes benzene, trichloroethylene, toluene, vinyl chloride, arsenic, PCBs, and tetrachloroethylene. At one point approximately 8,700 drums were on site, as well as thousands of cubic yards of contaminated sludge.

IV.D. Site Initial Responses

A partial removal was conducted at the site between 1977 and 1979 by the State of Michigan (the "State") with the assistance of the new and present site owner Cordova Chemical Company. Cordova agreed to neutralize and dispose of phosgene gas and pay the State to address other problems at the site. Removal activities included removal of stockpiled drums and thousands of cubic yards of contaminated soils and sludge. By the time of the removal, a contaminant plume containing at least 40 organic chemicals had migrated to the southeast, contaminating Little Bear Creek, its unnamed tributary, and several private wells. Residents were supplied with bottled water until connections to the municipal water system were installed in 1982. The site was placed on the National Priorities List (NPL) in 1982 and U.S. EPA completed a Remedial Investigation and Feasibility Study (RI/FS) in 1990.

IV.E Site Risks - Basis For Taking Action

IV.E.1. Operable Units #1 and #2 - Groundwater

The O.U. #1 and O.U. #2 Records of Decision provided the following discussions of the risk at the site associated with the site's contaminated groundwater:

> "The chronic hazard index value exceeded unity in 19 monitoring wells. Consequently, were groundwater used in its present state, there is a health risk with regard to noncarcinogenic chemicals ..."
>
> "With regard to carcinogenic indicator chemicals, cancer risks for at least one compound exceeded $1x10^{-6}$ in 22 wells. ....Additive excess cancer risk... is approximately $9x10^{-4}$, primarily from 1,2 - Dichloroethane, Vinyl Chloride, and Tetrachloroethane ... Primarily due to the known human carcinogen Vinyl Chloride, excess cancer risk associated with groundwater ingestion at well B1 is $4x10^{-2}$; at well OW-8 such risk is in excess of $1x10^{-1}$"

Table 1 provides a limited comparison of contaminants found in site groundwater, cited in the O.U. #1 and O.U. #2 RODs. Table 1 compares this information against recent sampling data and against the cleanup standards required by the RODs. This table is a "limited" comparison because there have been additional contaminants discovered since the Records of Decision, making a direct comparison not possible.

IV.E.2. Operable Unit #3 - Soils and Sediment

Table 2 shows the type and maximum concentrations of contaminants in O.U. #3 soil (Figure 4) that was the reason for excavation of Areas F, G, and R, and lists current cleanup standards in State law. Tables 3 and 4 show the type and maximum concentration of contaminants discovered in the water and sediments of Little Bear Creek and its unnamed tributary (Figure 3). The O.U. #3 remedy as modified by the 1998 Amendment to the ROD resulted in a recommendation to monitor the Creek and Creek sediment. Although the O.U. #3 ROD allowed the possibility of excavation and treatment of sediments, removal of contaminated sediment will not occur unless monitoring data suggests removal is necessary. In the State of Michigan, sediment cleanup criteria are developed on a site specific basis. MDEQ continues to collect and evaluate site data to develop site specific sediment cleanup standards.

Table 5 summarizes all risks that were associated with the contaminated soil formerly in O.U. #3 areas. As shown, the greatest risks associated with O.U. #3 are to a future resident ($3x10^{-4}$; Hazard Index (HI) of 2.4) and future worker ($1x10^{-4}$). Consideration of all the contaminants found on-site results in the greatest risk to a future site worker ($1.52x10^{-4}$), a future maintenance worker ($2.0x10^{-4}$), and a future resident ($5.81x10^{-4}$). Risk values shown in Table 5 also consider the likelihood of a future site resident or visitor being exposed to both plant area soils and/or Creek water and sediments. Risk shown in Table 5 has been addressed by the O.U. #3 Remedial Action (excavation) which was certified complete in March 2002.

V. REMEDIAL ACTIONS

V.A. Operable Unit #1

A Record of Decision (ROD) for O.U. #1 was signed September 29, 1989. At the request of certain parties, U.S. EPA re-opened and affirmed the remedy selected by this ROD on March 3, 1990. Remedy requirements as discussed in the O.U. #1 ROD are:

1. installation of extraction wells to intercept flow of contaminated groundwater which would otherwise enter the Little Bear Creek system;
2. environmental monitoring to ensure the effectiveness of the remedial action; and
3. provision for adequate treatment of groundwaters thus collected such that the resultant discharge will meet National Pollutant Discharge Elimination System (NPDES) limitations as imposed by the program administered by the Michigan Department of Environmental Quality (MDEQ).

V.B. Operable Unit #2

A ROD for O.U. #2 was signed September 29, 1990 and is a continuation of the O.U. #1 remedy. Remedy requirements as discussed in the O.U.#2 ROD are:

1. phased installation and operation of extraction wells designed to restore the aquifer and prevent degradation of useable groundwater resources at the southern boundary (downgradient edge) of the plume of contamination;
2. installation and operation of a purge and treatment system at points in the unconfined and semiconfined aquifer system specifically designed:
   a. to halt movement of the contaminated groundwater plume;
   b. to reduce pollutant mass;
   c. to restore the aquifer to useable conditions, specifically to acceptable Federal or State standards, whichever are more stringent;
   d. to be sufficiently flexible to allow modifications of the design of the purge system based upon operating experience; and
   e. to allow for continued definition of the extent of groundwater contamination;
3. installation of a groundwater monitoring system that:
   a. demonstrates the effectiveness of the aquifer restoration;
   b. demonstrates complete capture and treatment of the groundwater plume;
   c. identifies the most efficient locations for extraction wells; and
   d. is capable of determining when the aquifer is sufficiently restored to allow wells to be taken out of service; and
4. provision for adequate treatment of groundwater by construction of a Groundwater Treatment Facility (GWTF) such that the resultant discharge will meet requirements determined by the authorized State of Michigan program, specifically NPDES discharge limitations as administered by MDEQ.

The remedy goal discussed in the O.U. #2 ROD is restoration of the aquifer to National Primary Drinking Water Standards required by the Safe Drinking Water Act (40 CFR 141), or standards required by Act 307 of the Michigan Environmental Response Act ("Act 307") whichever are more stringent. 40 CFR 141 specifies maximum chemical contaminant levels (MCLs) for inorganic and organic chemicals. The standards required by Act 307 have since been replaced by Part 201 of the Natural Resources and Environmental Protection Act (Environmental Remediation), PA 451 of 1994, as amended ("Part 201").

V.C. Operable Unit #3

O.U. #3 remedy work intends to: reduce infiltration through contaminated soils which may add to the burden of groundwater contamination to be dealt with by O.U. #1 and O.U. #2; eliminate the primary human health risks posed by direct contact with contaminated soil; and eliminate the threat to the environment.

1. A ROD for O.U. #3 was signed September 27, 1993 to address plant area soils (source contamination) and sediment in Little Bear Creek and its unnamed tributary. Remedy requirements as discussed in the O.U.#3 ROD were:
   a. excavation of contaminated soils/sediments;
   b. treatment of such materials using low temperature thermal desorption (LTTD);

c. on-site backfilling of treated soils which meet soil cleanup criteria consistent with a future residential land use scenario;
d. off-site disposal of treated soils which do not attain cleanup criteria; and
e. environmental monitoring to ensure cleanup criteria are attained.

2. An amendment to the O.U. #3 ROD (the "O.U. #3 ROD Amendment") was signed February 26, 1998 and changed the remedy to reflect reasonably anticipated future land use of the site and to incorporate revised State of Michigan cleanup criteria. Remedy requirements as discussed in the O.U. #3 ROD Amendment are:
a. elimination of the need for LTTD;
b. excavation of a lesser volume of soils to meet acceptable State soil cleanup standards and off-site disposal;
c. regular sampling of surface water and sediments to determine the need for remedial action in the Little Bear Creek system in addition to the original environmental monitoring to ensure cleanup criteria are attained; and
d. implementation of deed restrictions in the form of restrictive covenants to insure that use of the site remains industrial. These deed restrictions will soon be recorded with the Muskegon County Register of Deeds when ownership of the site property is taken over by Muskegon County from the current site owner, Cordova Chemical.

Revision of State cleanup standards resulted in a reduction in the volume of soil requiring remediation at the site. In addition, based on information acquired after the 1993 ROD, a high potential for re-contamination of treated soils by contaminated groundwater would remain under the original LTTD remedy, thereby calling into question the effectiveness of treatment and on-site disposal. After evaluating remediation goals of the O.U. #3 ROD and reasonable future land use, it was concluded that it is more feasible to restore the site for future industrial use. The remedy goal discussed in the O.U. #3 ROD are soil cleanup standards required by Act 307, since replaced by Part 201 and accounted for by the O.U. #3 ROD Amendment. Except for operation and maintenance (O&M), long-term monitoring, and recording of restrictive covenants, O.U. #3 remedy work was certified complete in March 2002.

V.D. Enforcement Activity

Pursuant to CERCLA § 122, U.S. EPA issued Special Notice letters to Potentially Responsible Parties (PRPs) on October 15, 1982, August 2, 1985, and May 9, 1989. The major PRPs at the site included Dr. Arnold Ott, Corn Products Company (or CPC International, later known as Best Foods, and since purchased by Unilever Inc.), and Aerojet-General, owner of Cordova Chemical, the current site property owner.

On March 12, 1990, U.S. EPA issued a unilateral order (UAO) pursuant to CERCLA § 106 to Aerojet and CPC to implement a remedial design (RD) and remedial action (RA) for O.U. #1. Both Aerojet and CPC refused to comply with that UAO. On February 4, 1991, U.S. EPA issued a second UAO to Aerojet and CPC to implement RD/RA for O.U. #2. Aerojet and CPC again refused to comply. As a result of Aerojet's and CPC's refusal to comply, U.S. EPA terminated

these Administrative Orders on May 10, 1993 and proceeded with the O.U. #1 and O.U. #2 RD and RA using Federal funds. On September 29, 1992, U.S. EPA Region 5 received a $250,000 settlement from Dr. Arnold Ott.

In May and June 1991, the Western District Court of Michigan conducted a fifteen-day bench trial, CPC Int'l Inc. v. Aerojet-General Corp., 777 F. Supp. 549 (W.D. Mich. 1991), to determine which parties were responsible. On August 27, 1991, both Aerojet and CPC were found to be liable under CERCLA §107 by the District Court. An appeal by CPC and Aerojet resulted in a July 14, 1995, 2-1 ruling by a panel of the U.S. Sixth Circuit Court that reversed the District Court determination.

After a petition by the United States and the State of Michigan ("State"), the U.S. Sixth Circuit Court of Appeals granted the United States' and the State's request for a rehearing en banc, and on May 13, 1997, in a 7-5 decision, the U.S. Sixth Circuit Court reversed the District Court's decision. The United States and the State then petitioned to the U.S. Supreme Court to grant certiorari review of the case. The U.S. Supreme Court granted certiorari and on March 24, 1998 the case was argued. A June 8, 1998 decision by the U.S. Supreme Court rejected the standard articulated by the Sixth Circuit and set a new standard for establishing when a parent corporation will be considered liable as an operator under CERCLA. The case was remanded back to the District Court for a determination of liability applying the standard set by the Supreme Court. On April 14, 1999, a settlement was reached with Aerojet / Cordova which resolved their liability to both the United States and the State. On Nov. 9, 2001, the District Court found Unilever not liable. As a result, U.S. EPA and the State are responsible for all future remedy work at the Ott/Story/Cordova site and groundwater.

A 1977 agreement between Cordova and the State regarding surface soil, sludge removal, and groundwater contained language wherein the State purported to indemnify Cordova from future environmental liability. A decision by the Michigan Court of Appeals on July 14, 1995 upheld the indemnification. On April 14, 1999, the U.S. EPA Region 5 Superfund Division Director signed a Consent Decree for completion of the O.U. #3 portion of the site remedy by Aerojet / Cordova, relieving the U.S. Government of that responsibility. This Consent Decree allowed the State to complete the O.U. #3 portion of the site remedy on behalf of Aerojet/Cordova. The Consent Decree also resolved Aerojet / Cordova's liability at the site.

V.E. Remedy Construction Activities

In February 1991 through an Inter-Agency Agreement (IAG), U.S. EPA authorized the U.S. Army Corps of Engineers (USACE) to begin Remedial Design activity. In September 1991, U.S. EPA authorized USACE to acquire access to property for installation of the O.U. #1 extraction wells. In October 1993, the design of the GWTF was completed and USACE awarded a contract for construction activities for both Operable Units #1 and #2. In February 1996, after appropriate leak testing and initial shakedown activity, treatment of contaminated groundwater started at a reduced flow rate. Groundwater treatment at GWTF full design flow rate was not

possible due to limited capacity of the existing Cordova treated water effluent discharge pipe line that was being used. A new, larger effluent pipeline has been constructed to increase the flow of groundwater up to GWTF full design capacity as needed. The GWTF was declared fully operational and functional by U.S. EPA and MDEQ (the "Agencies") on August 9, 2000.

In September 1993 the design for the original O.U. #3 LTTD remedy was started by USACE and completed in April 1995. At that time, a contract was awarded and the site was prepared for a mobile LTTD unit. In July 1995, LTTD work was halted by U.S. EPA after consideration of recent changes to State of Michigan cleanup standards, increases shown in post-ROD cost estimates, and the fact that contaminated groundwater could permeate treated areas during periods of increased groundwater levels, potentially 're-polluting' clean soils. U.S. EPA issued the O.U. #3 ROD Amendment on February 26, 1998 and after appropriate negotiations, a Consent Decree for MDEQ's completion of the O.U. #3 portion of the site remedy was signed on April 14, 1999. Under MDEQ management, the LTTD design documents were revised to reflect the new requirements for excavation and off-site disposal. Areas F, G, and R, and an additional 6 areas identified by MDEQ to allow re-development of the property have all been completed ahead of the schedule originally prepared.

At this time, until an assessment of the remedy goals and possible adjustment of the existing remedy is determined to be necessary by U.S. EPA and MDEQ, there are no remaining requirements for U.S. EPA and successful completion of remedy construction at this site by U.S. EPA has been achieved.

V.F. Final Inspection - Certification of Operational and Functional Status

A September 14, 2000 letter was provided by MDEQ certifying their concurrence with the August 9, 2000 declaration of operational and function (O&F) status for the GWTF and existing extraction wells. O&F status had been delayed due to the GWTF flow limitations caused by inadequacies associated with the effluent pipe line. Two informal GWTF walk throughs were performed conjointly by U.S. EPA and MDEQ to identify substantive incomplete work items, subsequently resolved. For the O.U. #3 soil remedy, a visual inspection of the excavated and filled areas was completed on Thursday March 21, 2002. MDEQ concurred that Areas F, G, and R identified by the O.U. #3 ROD Amendment have been successfully excavated and back-filled with clean soil. Therefore, the O&F date of the O.U. #3 areas as required by the U.S. EPA ROD Amendment is March 21, 2002. Additional minimal work not directly related to the O.U.#3 ROD Amendment remedy has also been completed by MDEQ for the purpose of potential re-development of the site property. This work, along with nominal O&M of O.U. #3 areas, complete the work from the State of Michigan required by the O.U. #3 Consent Decree. Appropriate quality assurance and quality control was performed during all phases of remedy construction. Throughout the construction activities for all operable units, there has been monitoring of contaminated media.

V.G. Achievement of Remedy Cleanup Goals

Table 1 provides a limited comparison of contaminants found in site groundwater and cited in the O.U. #1 and O.U. #2 RODs against recent sampling data and cleanup standards required by the RODs. Table 6 provides a limited comparison of groundwater contaminants cited in the O.U. #1 and O.U. #2 RODs against GWTF influent concentrations, against contaminant levels in treated water, and against discharge permit limits established by MDEQ. Tables 3 and 4 provide a limited chronological history of contaminants found in Creek water and sediment. All tables are "limited" comparisons because there have been additional contaminants discovered since the Records of Decision, making a direct comparison not possible.

As shown by these tables, implementation of the O.U. #1 / O.U. #2 remedy has decreased concentration of contaminants in groundwater. Although the O.U. #2 remedy goal is restoration of the groundwater aquifer to useable status (which in effect is achievement of MCLs or Michigan Part 201 standards), the remedy has not yet been operating long enough to realize this goal. It is anticipated based on the contaminant reduction to date that the remedy goal can eventually be achieved. Table 6 shows that the GWTF successfully achieves permit limits and has been in compliance since the start of treatment in 1996. The O&F declaration date of August 9, 2000 has allowed the new, larger effluent pipeline to operate for an adequate time to demonstrate the same degree of successful treatment.

In March 2002, U.S. EPA performed a final inspection of O.U. #3 soil areas and certified that excavation of contaminated soil and back-filling work was complete. Table 4 shows a decrease in contaminant concentrations in sediment, suggesting that the O.U. #1 / O.U. #2 remedy has been successful in capturing contaminated groundwater before it reaches the Creek. Capture of contaminated groundwater has resulted in Creek water and sediment contaminant levels that are lower than the levels cited in the site Records of Decision. The State of Michigan, as required by the scope of work for their O.U. #3 remedy, will continue to monitor surface water and sediment on a long-term basis and will develop site specific sediment cleanup standards. The State of Michigan will implement any active remediation effort for Little Bear Creek and its unnamed tributary if it is determined to be necessary at a later date.

V.H. Operation and Maintenance (O&M)

A contract was awarded in August 1999 for LTRA and O&M of the GWTF and extraction well systems, which is the major portion of the remedial action effort at the site. USACE continues to supervise the award and administration of this contract and the oversight of LTRA and O&M activity. In addition to operating the extraction and treatment processes, LTRA and O&M tasks include: procurement of utilities such as gas, water, communications, and electricity, extraction well cleaning and preventive maintenance, possible re-development of wells as needed, continued groundwater sampling and analysis, general repair, maintenance, and minor improvements to the system(s) and GWTF buildings and grounds, repair and minor upgrade of: groundwater collection piping and valving, emission control equipment, residuals handling

equipment, monitoring wells, and extraction well vaults and associated equipment. MDEQ is responsible for O&M of O.U. #3 areas, which includes sampling and analysis of surface water and sediment and (only if deemed necessary) plant area soil. If required, MDEQ would also be responsible for any general security enhancements (fencing, etc.) for the former plant area. However, many of the tasks required for site O&M, such as groundwater monitoring, may be addressed during the O&M of O.U. #2.

V.I. Costs

The Record of Decision for O.U. #1 provided a general cost estimate for the scope of work for both O.U. #1 and O.U. #2 that was revised in the O.U. #2 ROD as follows: $6,000,000 capital cost; $1,400,000 annual O&M cost; $20,000,000 present worth of annual O&M cost; $26,000,000 project net present worth.

Actual O.U. #1 / #2 costs are shown in Tables 7 and 8. Capital costs for the O.U. #1 and O.U. #2 remedy (including Long Term Response Action costs) are $45,871,000. The approximate annual O&M cost for the O.U.#1 / #2 groundwater remedy is $2,450,000, or a present worth of approximately $37,660,000 for a 30 year remedy operation time period at a 5 percent discount rate. Considering the LTRA cost to date as "O&M" cost, the O.U. #1 / #2 net present worth is approximately $78,031,000. For the purposes of this Five Year Review, 30 years is being used even though it is possible that the site remedy may need to operate longer. For operation greater than 30 years, the O.U. #1 / #2 net present worth increases to a value between $80,000,000 and $94,500,000. These costs do not include U.S. EPA, U.S. Department of Justice, or State of Michigan payroll, travel, contractor, and indirect costs. USACE costs have been included because of the extensive requirements for administration of U.S. Government contracts. As the O.U. #1 / O.U. #2 remedy continues to operate, optimization efforts have resulted in a reduction in the annual amount of annual funding authorizations. For the year 2003, authorization is being obtained for $2,500,000. It is expected that annual cost will continue to decrease.

The Record of Decision for O.U. #3 provided a general cost estimate for excavation and LTTD treatment as follows: $6,654,254 capital cost; $10,000 annual O&M cost; $154,000 present worth of annual O&M cost; $ 6,808,254 project net present worth.

Cost for the recent O.U.#3 demolition and soil removal remedy work was approximately $2,800,000 including sampling and analysis and oversight contractor costs. Tables 9 and 10 shows the annual cost estimate for potential O&M tasks for O.U. #3 areas as approximately $100,000. For a 30 year remedy operation time period and a 5 percent discount rate, the present worth of this estimate is approximately $1,544,000, for a project net present worth of approximately $4,544,000. It is anticipated: that the O.U. #3 remedy will not need to operate longer than 30 years; that there should not be extensive sampling and analysis of O.U. #3 plant area soils; and that there should not be extensive site security required for O.U. #3. The main O&M task for O.U. #3 is sampling and analysis of the Little Bear Creek system. Groundwater monitoring and site security are generally handed within the scope of the O.U. #2 remedy. In

addition to this total, U.S. EPA expended approximately $4,500,000 for the discontinued O.U. #3 LTTD work, including design cost, bringing up the net project present worth of O.U. #3 to approximately $9,044,000. This does not include U.S. EPA, U.S. Department of Justice, or State of Michigan payroll, travel, contractor, and indirect cost.

In sum, total cost expended to date for this project is $ 53,371,000, with a potential for the total net present worth for this project ranging between $ 85 and $ 100 million. Actual remedy costs are much higher than cost estimates shown in the Records of Decision.

VI. PROGRESS SINCE LAST FIVE-YEAR REVIEW

On August 13, 1997 a Five Year Review was completed by U.S. EPA Region 5. Because construction and start-up of revisions to the GWTF was still under way, and because the final revisions to the design and scope of O.U. #3 remedy work had not been finalized, the 1997 report consisted of a Type Ia review. Except for continuation of Remedial Action activity, there were no recommendations or follow-up items required from the 1997 Five Year Review because construction and start-up activity for the site remedy was not complete at that time.

The first Five Year Review certified that

> "... at this point in time, the remedy selected for this site remains protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the Remedial Action, and is not inconsistent with additional Operable Units for this site or any potential future Remedial Actions."

In the past five years, the GWTF has been certified Operational and Functional and O.U. #3 work has been completed. Reduction in contamination continues to be documented. Current site work consists of tasks constituting the Long Term Response Action (LTRA) for groundwater, routine O&M of the constructed remedies, and optimization of the O.U. #1 / O.U. #2 remedy. In 1995, State of Michigan Applicable or Relevant and Appropriate Requirements (ARARs) changed. At the time of the first Five Year Review in 1997, U.S. EPA was compiling the O.U. #3 ROD Amendment and incorporated these revised ARARs in that decision document for the O.U. #3 remedy.

VII. FIVE-YEAR REVIEW PROCESS

VII.A. Administrative Components

As a result of the legal proceedings summarized in Section II.D of this Five Year Review Report, there are no longer any PRPs that would require notification of this five year review. MDEQ and USACE are active participants in the operation of this remedy, as are the contractors Fishbeck, Thompson, Carr, and Huber (FTCH) and Black and Veatch (BV). FTCH is doing the LTRA / O&M work and BV continues to provide limited Remedial Action support through supplemental monitoring, computer modeling, and general remedy evaluation work. As part of monthly

update meetings, notifications of U.S. EPA's five year review process have been provided to USACE, MDEQ, FTCH and BV. Representatives of these organizations were involved in the site visit(s) and drafting of this Five Year Review Report.

Because U.S. EPA routinely visits and inspects the site each month, and because full time operators are regularly monitoring all remedy components, no inspection tasks specific to this five year review were needed. This five year review is based on quarterly monitoring reports, monthly operation reports, historical and current data, and supplemental evaluations of all data and ARARs (by BV).

VII.B. Community Notification and History of Involvement

The area surrounding the site is semi-rural, with approximately 300 to 500 residents in a one-mile radius of the site. All residences use potable water supplied by pipeline from the local public water system. There has not been active interest in the site from the community since the time of remedy decisions, design, construction, and start up approximately 6 years ago. Therefore, no community interviews were conducted for this Five Year Review. However a notice will be provided regarding the availability of this report to the general public in a newspaper of local interest, the Muskegon Chronicle. U.S. EPA Region 5 will provide further community involvement events if additional community interest results from this Five Year Review Report.

This Five Year Review Report will be placed with all other site related documents as part of the Administrative Record File, available for public inspection at the following locations:

Walker Branch Library
1522 Ruddiman Drive
Muskegon, Michigan

Dalton Township Hall
1616 East Riley Thompson Road
Dalton, Michigan

The Administrative Record may also be reviewed at:

U.S. EPA Region 5
77 West Jackson Boulevard
Chicago, Illinois

Within the past 6 years of construction, start-up, and operation (LTRA) activity, community interest has been minimal. Community involvement was active at the time of development of the Records of Decision and during the remedy's design, construction, and start-up. A notice will be provided regarding the availability of this report to the general public in a local newspaper, the Muskegon Chronicle. U.S. EPA Region 5 will provide further community involvement events if additional community interest results from this Five Year Review Report.

Because of the extensive enforcement and legal activity associated with this site, the status and future use of the site property was unknown until November 2001. Cordova Chemical Company, the most recent owner of the site property, intends to make the property available at little cost to the local county government, Muskegon County (the "County"). Because the O.U.#3 remedy work has been successfully completed by MDEQ, the site property can be re-developed in accordance with the reasonable future land use established by MDEQ (industrial use). At this point in time, the County intends to have the property re-developed for use by a commercial or industrial user.

VII.C. Document Review

The documents that were reviewed for this five year review were quarterly monitoring reports, monthly operation reports, historical and current data, the computer groundwater model, and supplemental evaluations of all data. In addition, Applicable or Relevant and Appropriate Requirements (ARARs) were reviewed to identify those ARARs that have been revised since the Records of Decision (as amended). This five year review report is based on quarterly monitoring reports, monthly operation reports, historical and current data, and supplemental evaluations of that data. As part of its Remedial Action support contract awarded through USACE, BV was tasked to assess the effectiveness of the remedy to date after 6 years of operation. This assessment includes a document review of all quarterly monitoring and system operating information, comparison of current and historical data against original cleanup standards in the Records of Decision (as amended), and comparison of data against State of Michigan cleanup standards revised in 1995.

VII.D. Data Review

Since the initiation of the site's remedial actions, BV has provided quarterly monitoring of wells associated with the Ott/Story/Cordova project. Tables 1, 3, and 4 summarize the results of this monitoring and show a decrease in the contaminant levels in groundwater. MDEQ has certified that O.U. #3 areas have been excavated to depths where contaminant levels are within acceptable levels for future industrial land use. Based on operating data to date, BV is revising the remedy time period estimated to achieve cleanup standards. The time period used in the original RODs for the groundwater portion of the site remedy was 30 years, based on standard engineering practices and standardized project life time period. A better estimate for the overall project time period is being developed using computer modeling. In addition, supplementary sampling and analysis of a deep well in the plant area and other monitoring wells at the edge of the groundwater contaminant plume will be performed as needed to assist in assessing the site remedy's goals.

VII.E. Site Inspection

Within the past 6 years of construction, start-up, and operation (LTRA) activity, no issues or information have arisen that question the remedy's effectiveness. In this time period, except for

the reduction in contaminant concentrations, there have not been any changes to the site since the Records of Decision. Because it is a Fund lead project, an operations meeting with a site inspection and remedy operations meeting has occurred every month since the Remedial Action was initiated. Monthly meeting participants include the U.S. EPA RPM, the MDEQ Project Manager, occasionally a MDEQ Surface Water Quality Division representative, USACE, FTCH, and occasionally BV. The groundwater treatment plant and extraction wells are inspected monthly. These inspections and meetings on a monthly basis ensure that the remedy constructed at the Ott/Story/Cordova site is operating as designed and is protective of human health and the environment. A formal inspection by the RPM to certify the completion of excavation of contaminated soil and back-filling in O.U. #3 areas occurred in March 2002 during one of the monthly meetings.

VIII. TECHNICAL ASSESSMENT

Question A: Comparison of remedy operations against decision documents.

Table 1 shows that, for groundwater contaminants listed, a reduction in contaminant concentrations can be seen, but that the cleanup goals have not yet been achieved. As previously mentioned, it has been certified that the excavation and back-filling of O.U. #3 areas was successful. Tables 3 and 4 show that contaminants in the water and sediment of Little Bear Creek and its unnamed tributary have been lowered but are still present. These sediments continue to be monitored by MDEQ. The remedy as constructed is functioning as intended by the site decision documents.

Question B: Validity of exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy against current conditions.

Because U.S. EPA risk assessment procedure and calculation has not changed since the O.U. #1 and #2 Records of Decision, and because there has been no change in the population of residents near the site, the exposure assumptions for this site have not changed. Additional data for O.U.#3 was obtained in 1995-96 which resulted in the 1998 O.U. #3 ROD Amendment.

Current conditions show a reduction in contaminant levels. In order to ensure that U.S. EPA and MDEQ will be operating the most effective remedy, re-calculation of site risks and a ROD Amendment or Explanation of Significant Difference (ESD) may be issued in the future for Operable Units #1 and #2. At the time of the O.U. #1 and O.U. #2 Records of Decision, formal cleanup standards for some of the identified contaminants at the Ott/Story/Cordova site were not available. Further, the O.U. #1 and #2 RODs were written without a definitive estimate for the long-term remedy time period. An update to the site's groundwater computer model that considers the remedy's effectiveness to date will provide a better time estimate. U.S. EPA Region 5 will revise the O.U. #1 / #2 remedy decision documents as needed to ensure the most optimal remedy.

Question C: Assessment of new information that may question the protectiveness of the remedy.

Since the time of the 1998 O.U. #3 ROD Amendment, there has been no additional information that may question the protectiveness of the remedies for any Ott/Story/Cordova operable unit. The original O.U. #1 and #2 RODs will likely need to be modified based on: a re-calculated risk assessment (to incorporate reduced contaminant levels), assessment of current remedy costs, a more definitive estimate for the time period needed to reach cleanup goals, revisions to cleanup goals based on ARARs established after the original O.U. #1 and #2 RODs were issued (including the 1995 revisions to State of Michigan cleanup standards), and the anticipated reasonable future land use for the Ott/Story/Cordova property. Revised State of Michigan standards may provide cleanup standards that may be reached in a shorter time period for the most reasonable future land use. In addition, revisions to the O.U. #1 and #2 remedy may also provide better cost effectiveness.

Technical Assessment Summary

The remedy as constructed is functioning as intended by the site decision documents. The exposure assumptions for this site have not changed. Current conditions show continuing reductions in contaminant levels. Since the time of the 1998 O.U. #3 ROD Amendment, there has been no additional information that may question the protectiveness of the remedies for any Ott/Story/Cordova operable unit.

IX. ISSUES

Because there have been changes to ARARs for this site, there were no cleanup standards available for some contaminants identified in the RODs, there has been a decrease in contaminant concentrations, and because annual remedy costs are now better known, the O.U. #1 and O.U. #2 remedy should be re-assessed and possibly modified by another remedy decision document, either a ROD Amendment or an Explanation of Significant Difference (ESD). In addition, a ROD Amendment or ESD is not inconsistent with the current effort to optimize the O.U. #1 / O.U. #2 pump and treat remedy. It is recommended to adjust the requirements of a remedy to better reflect remedy work to date (decreased contaminants and remedial experience), to ensure a remedy's cost and cleanup effectiveness, and to document the differences between ROD and design cost estimates and actual remedy costs.

Extensive enforcement and legal activity associated with this site delayed a determination of the possible future use of the site property. The November 2001 decision essentially determined that the remedy for this site will remain under the authorities of U.S. EPA and MDEQ. Cordova Chemical Company, the most recent owner of the site property, intends to make the property available at little cost to the County. U.S. EPA and MDEQ have been involved with the negotiations of this land transfer and understands that the County intends to have the property re-developed for use by an industrial user. Because the O.U. #3 remedy work has been successfully

completed by MDEQ, this re-development is not inconsistent with the reasonable future land use established by MDEQ (industrial use). Deed restrictions will be implemented by the County, and a Prospective Purchasers Agreement is being executed with consultation by U.S. EPA and MDEQ.

To alleviate annual costs for the O.U. #1 / O.U. #2 remedy, it may be possible for U.S. EPA and MDEQ to enter into an agreement to share the use of the GWTF. Eventual users of the site property may have some non-potable use for the treated water currently being discharged to the Muskegon River . It may be possible to develop one of the following types of agreements: a cost sharing or operators agreement with the County's POTW authority to use the GWTF to help alleviate the POTW's industrial load; an agreement (with a non-profit subsidy to U.S. EPA and MDEQ) for non-potable use of the GWTF's treated groundwater by the eventual user of the site property, or; an agreement with the County (the landowner) for the County's assumption of GWTF operations (the County could make treated water available for non-potable use for their tenant(s), who would pay the County for this service). The details of such an agreement are unknown at this time because the land transfer is still under way.

Pump and treat optimization recommendations have been made for this site that would require additional capital construction funds to eliminate and replace certain process technologies installed in the GWTF. U.S. EPA and MDEQ have deferred any GWTF retrofit because it may be possible to drastically reduce or eliminate the Agencies' annual GWTF cost through a GWTF operation agreement with the eventual user of the site property.

X. CONCLUSIONS, RECOMMENDATIONS, AND FOLLOW-UP

The remedies for all operable units have been constructed and are operating successfully. Normal LTRA and O&M work guarantee that the Ott/Story/Cordova site is monitored closely and there is a continued on site presence of U.S. EPA, MDEQ, and USACE (or their contractors). There is a decrease in contaminant concentrations throughout the known contaminant plume and contaminated soils have been removed from the site. Absent retrofit of the GWTF, the pump and treat remedy is continually being optimized based on cleanup and cost efficiencies.

A remedy decision document, either a ROD Amendment or ESD, for the O.U. #1 / O.U. #2 remedy should be developed and issued by U.S. EPA and MDEQ. Changes to ARARs, optimization of the constructed remedies, adjustment of remedy requirements and goals to reflect the most optimal cleanup process, better cost effectiveness, and the differential between ROD cost estimates and actual remedy costs must be addressed by this remedy decision document.

Because of the extensive enforcement and legal activity associated with this site, future use of the site property was unknown until November 2001. Cordova Chemical Company, the most recent owner of the site property, intends to provide the property to the local county government (Muskegon County). Because the O.U. #3 remedy work has been completed successfully by

MDEQ, the site property can be re-developed in accordance with the reasonable future land use established by MDEQ (industrial use). U.S. EPA and MDEQ will continue to be involved with these negotiations and development of any Prospective Purchasers Agreement. U.S. EPA and MDEQ understand that the County intends to have the property re-developed for use by an industrial user. Eventually an agreement may be developed with the County to drastically reduce or eliminate GWTF costs and allow the non-potable use of treated water by the eventual user of the site property. If such an agreement is not developed, U.S. EPA and MDEQ will implement optimization recommendations to the pump and treat remedy, in concert with adjustment of the remedy's goals. An approximate schedule for implementation of these recommendations is shown in Table 11.

XI. STATEMENT OF PROTECTIVENESS

The O.U. #1 / O.U. #2 remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through pump and treat technology, which is now expected to require no less than 28 more years to achieve. In the interim, groundwater exposure pathways that could result in unacceptable risks are being controlled with groundwater containment through extraction, and the removal of contaminated soil. Nearby residents are not using groundwater for potable uses. The O.U. #3 remedy was certified complete in March 2002 after contaminated soil was removed from the site and excavated areas replaced with clean soil.

Institutional control in the form of a deed restriction for industrial / commercial use is being implemented by the property owner. A continued presence by U.S. EPA's operations contractor provides security for site property, even though the threat posed by contaminated soil has been removed. All threats at the site have been addressed through: removal of contaminated soil, continued capture and extraction of contaminated groundwater before reaching Little Bear Creek and its unnamed tributary, and treatment of that contaminated groundwater in the GWTF.

Long term protectiveness of the remedial action is continually being verified by LTRA and O&M monitoring, and current data indicates groundwater containment is successful and contaminant levels are dropping. Sampling and analysis is ongoing and data indicates that these dropping levels confirm an eventual achievement of remedy goals.

XII. NEXT REVIEW

The next review will be by September 30, 2007, approximately five years after the approval of this Five Year Review Report. In the interim, an ESD or ROD Amendment will be issued.

TABLE 1 - GROUNDWATER SUMMARY [1]; Ott/Story/Cordova Site

CONTAMINANT	FEDERAL MAX. CONTAMINANT LIMIT (MCL) (ppb)	MI PART 201 RESIDENTIAL GROUNDWATER CLEANUP STD. (ppb)	SAMPLE LOCATION IN CONTAMINATED AREA	CONTAMINANT LEVEL CITED IN ROD[2] (1989) (ppb)	6 MONTHS AFTER GWTF START-UP (Sept. '96) (ppb)	SEPT. 2001 RESULTS (5 yrs of GWTF operation) (ppb)
Benzene	5	5	W 101 S	3800	190	260
1,1 - Dichloroethene	7	7	OW-12	1100	130	39
			OW-9	7900	12 (OW-9D)	< 1.0 (OW-9D)
			W 101 S	350	25	< 1.0
			W 101 I	970	750	25
1,1 - Dichloroethane	N/A	880	OW-12	2400	230	38
			OW-9	6300	16 (OW-9D)	< 1.0 (OW-9D)
1,2 - Dichloroethane	5	5	OW-12	110000	440	680
			OW-9	21000	980 (OW-9D)	< 1.0 (OW-9D)
			W 101 S	2200	58	< 1.0
			W 101 I	110000	720	20
			W 101 D	8	5	< 1.0
Tetrachloroethene	5	5	W 101 S	24000	19000	60000
			W 101 D	55	17000	22000
Toluene	1000	790	OW-12	3200	570	220
			W 101 S	38000	23000	6400

TABLE 1 - GROUNDWATER SUMMARY [1]; Ott/Story/Cordova Site

CONTAMINANT	FEDERAL MAX. CONTAMINANT LIMIT (MCL) (ppb)	MI PART 201 RESIDENTIAL GROUNDWATER CLEANUP STD. (ppb)	SAMPLE LOCATION IN CONTAMINATED AREA	CONTAMINANT LEVEL CITED IN ROD[2] (1989) (ppb)	6 MONTHS AFTER GWTF START-UP (Sept. '96) (ppb)	SEPT. 2001 RESULTS (5 yrs of GWTF operation) (ppb)
Vinyl Chloride	2	2	OW-12	50000	2100	250
			OW-9	130000	74 (OW-9D)	7.8
			W 101 D	9	40	140
Benzoic Acid	N/A	32000	OW-12	1300	960 J	< 50

FOOTNOTES FOR TABLE 1

1 This is only a limited summary. Contaminants shown are provided only as a comparison against the limited list of groundwater contaminants cited in the site Records of Decision. There were additional contaminants identified after the RODs in groundwater and other media for this site. All values shown are in µg/L or parts per billion (ppb).

2 "ROD" is acronym for Record of Decision.

TABLE 2 - CLEANUP STANDARDS AND EXCEEDANCES FOR OTT/STORY/CORDOVA O.U. #3 SOIL EXCAVATION AREAS [1]

CONTAMINANT	O.U. #3 AREA	CLEANUP STANDARD[2] (ppb)	MAXIMUM CONTAMINANT CONC. (ppb)
Carbon Tetrachloride	Area R	100 (20 xDW)	26000
Tetrachloroethene	Area R	100 (20 X DW) 5 (RES) [4]	2300 (year 1988) 100 (year 1995, with leachate >5 ppb*)
1,1,1 - Trichloroethane	Area F	4000 (20 x DW)	17000
bis (2-ethylhexyl) phthalate	Area G,R	330 (TMDL)	1900, 560 J
4-Chloroaniline	Area G	N/A; 1660 ppb[5]	2700
1,2-Dichlorobenzene	Area R	12000 (20 x DW)	13000 J
1,4-Dichlorobenzene	Area R	1500 (20 x DW)	7600 J
Hexachlorobenzene	Area G	20 (20 x DW)	710
	Area R	20 (20 x DW)	980, 7800 J
Aldrin	Area F,G,R	20 (TMDL)	72, 52,29.5
4,4'-DDT	Area F,G,R	200 (20 x DW)	2700, 5900, 1200 J
Dieldrin	Area G	20 (TMDL)	140
Endosulfan I	Area G	96 (20 x DW)	190
Endrin	Area G	40 (20 x DW)	97
Methoxychlor	Areas F,G	800 (20 x DW)	8400, 5300
Arochlor 1248 (PCBs)	Area G,R	330 (TMDL)	5800, 950
TCDD Toxicity Equivalent (Dioxin)	Area F	0.001 (TMDL)	0.77
	Area G	0.001 (TMDL)	0.728

FOOTNOTES FOR TABLE 2

* An asterisk (*) denotes the confirmed exceedance of a current State standard (corresponding to 10^{-5} industrial risk). Excavation of soils is warranted in these areas based on addressing O.U. #3 risks associated with future industrial land use (identified in the 1993 ROD) and in accordance with State of Michigan standards.

1 Cleanup standards as shown in February 1998 Amendment to the Record of Decision for Operable Unit #3.

2 20 x DW - 20 times the Part 201 Industrial drinking water standard. This is the contaminant concentration in soils which, if exceeded, may cause leaching of contaminants into groundwater at levels exceeding acceptable drinking water standards.
TMDL - The Target Method Detection Limit is the lowest value accepted by the State of Michigan that laboratory equipment can measure. If the 20 x DW value is lower than what the laboratory can detect, then the TMDL becomes the cleanup standard.
DCV - Part 201 Industrial Direct Contact Value. This is the contaminant concentration in soils which, if exceeded, presents an unacceptable risk to human health and the environment within a typical industrial scenario. Any exposure to plant area soils would be to an individual working on the Site within a controlled work environment.

3 The 1998 O.U. #3 ROD Amendment established the requirement for excavation of Areas F, G, and R only, to depths shown (through sampling) as having no unacceptable concentrations of contaminants.

4 Residential Groundwater Criteria. In an Industrial scenario, the groundwater standard required by the State of Michigan for the compound Tetrachloroethene is the Residential Drinking Water Standard.

5 Estimated Cleanup Limit calculated by EPA contractor because no standard existed at the time of the 1998 O.U. #3 ROD Amendment. This value may be used during implementation of the Remedial Action to assist in determining adequate excavation depth and is included here for comparison purposes.

DATA QUALIFIER LEGEND

When chemical analysis data is submitted to U.S. EPA, limitations of analytical equipment must be noted with results so an accurate scrutiny can be performed. These limitations are shown as qualifiers, noted as letters next to numerical values. Explanations of these qualifiers are as follows:

J - Signifies a value that was estimated. This means that the compound was detected by the analytical equipment but the value shown may not be able to be reproduced exactly if the analysis were repeated.

B - Signifies a compound that was also detected in a blank. A blank is a 'clean' sample prepared in the laboratory, carried with field samples, transported, and stored. If contamination is found in a blank, there is a possibility that contamination may be from a source other than what was sampled (such as through faulty sampling, storage, transportation, or laboratory procedures).

D - Signifies that the sample shown had to be diluted for the lab equipment to show results that are reproducible.

TABLE 3 - SURFACE WATER SUMMARY [1]; Ott/Story/Cordova Site; Little Bear Creek and Unnamed Tributary

CONTAMINANT	LEVEL CITED IN ROD[2] (ppb)	MAX. LEVEL PRIOR TO 12/96 (ppb)	DATE OF SAMPLING EVENT [1]										
			12/96 (max.) (ppb)	3/97 (max.) (ppb)	9/97 (max.) (ppb)	3/98 (max.) (ppb)	9/98 (max.) (ppb)	3/99 (max.) (ppb)	9/99 (max.) (ppb)	3/00 (max.) (ppb)	9/00 (max.) (ppb)	3/01 (max.) (ppb)	9/01 (max.) (ppb)
Benzene	26	6000	33	17	18	35	8.7	3.3	2.6	ND [3]	ND	ND	ND
1,1 - Dichloroethene	ROD did not cite this contaminant as present in surface water		NOTE: Contaminant not analyzed during quarterly surface water sampling and analysis program.										
1,1 - Dichloroethane	26	26	2	0.69	0.57	1.6	ND	ND	ND	ND	ND	ND	ND
1,2 - Dichloroethane	140	140	ND	0.82	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ROD did not cite this contaminant as present in surface water		40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	22	6400	24	13	17	20	8	1.1	ND	ND	ND	ND	ND
Vinyl Chloride	52	52	NOTE: Contaminant not analyzed during quarterly surface water sampling and analysis program.										
Benzoic Acid	ROD did not cite this contaminant as present in surface water.		NOTE: Contaminant not analyzed during quarterly surface water sampling and analysis program.										
Tentatively Identified Compounds [4]	ROD did not cite this contaminant as present in surface water.		171	29	123	192	175.1	35	37	ND	ND	31	2.4

FOOTNOTES FOR TABLE 3

1 This is only a limited summary. Contaminants shown are provided only as a comparison against the limited list of groundwater contaminants cited in the site Records of Decision. There are additional contaminants identified within this and other media for this site. Sampling occurred from December 1996 to September 2001. Only the most significant results have been included here. All values shown are in µg/L or parts per billion (ppb).

2 "ROD" is acronym for Record of Decision.

3 "ND" - Contaminant not detected in laboratory analysis.

4 The term "Tentatively Identified Compounds" means that detections of organic chemicals occurred, but distinguishable identifications of a certain compound or isomer could not be made due to the similarity of contaminants within laboratory results.

TABLE 4 - SEDIMENT SUMMARY [1]; Ott/Story/Cordova Site; Little Bear Creek and Unnamed Tributary

CONTAMINANT	LEVEL CITED IN ROD[2] (ppb)	MAXIMUM LEVEL PRIOR TO Dec. 1996 (ppb)	DATE OF SEDIMENT SAMPLING EVENT [3]										
			12/96 (max.) (ppb)	3/97 (max.) (ppb)	9/97 (max.) (ppb)	3/98 (max.) (ppb)	9/98 (max.) (ppb)	3/99 (max.) (ppb)	9/99 (max.) (ppb)	3/00 (max.) (ppb)	9/00 (max.) (ppb)	3/01 (max.) (ppb)	9/01 (max.) (ppb)
Benzene	No sediment contaminants cited in ROD	47500	6280	27000	3500	15000	12000	410	190	110	470	ND	570
1,1-Dichloroethene		Not analyzed	ND [4]	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane		67	271	2200	ND	170	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane		7.25	ND	320	24	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene		591	NOTE: Contaminant not analyzed during quarterly sediment sampling and analysis program.										
Toluene		99000	4450	20000	4800	23000	20000	5500	40	2400	390	15	2400
Vinyl Chloride		Not analyzed	ND	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid		3640	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tentatively Identified Compounds [6]		Not analyzed	106601	246219	100820	122510	41450	55850	30200	12850	31000	8300	26300

FOOTNOTES FOR TABLE 4

1 This is only a limited summary. Contaminants shown are provided only as a comparison against the limited list of groundwater contaminants cited in the site Records of Decision. There are additional contaminants identified within this and other media for this site. Sampling occurred from December 1996 to September 2001. Only the most significant results have been included here. All values shown are in µg/L or parts per billion (ppb).

2 "ROD" is acronym for Record of Decision.

3 In the State of Michigan, sediment cleanup criteria are developed on a site specific basis.

4 "ND" - Contaminant not detected in laboratory analysis.

5 "NA" - Cleanup criterion is not available or not applicable at this time.

6 "Tentatively Identified Compounds" signify that detections of organic chemicals occurred, but distinguishable identifications of a certain compound or isomer could not be made due to the similarity of contaminants within laboratory results.

TABLE 5 - RISK ASSOCIATED WITH OTT/STORY/CORDOVA PLANT AREA SOILS AND LITTLE BEAR CREEK SYSTEM SEDIMENT AND SURFACE WATER (O.U. #3) [1]

RISKS IDENTIFIED FROM CONTAMINANTS OF CONCERN (EXCEPT DIOXIN) FROM BOTH SOILS AND SEDIMENTS*		
EXPOSED INDIVIDUAL	HAZARD INDEX [2]	LIFETIME CANCER RISK [3]
Current Resident and Trespasser	0.02	2 E -07
Future Worker	0.30	1 E -04
Future Construction Worker	0.46	3 E -06
Future Maintenance Worker	0.40	9 E -05
Future Resident	2.4	3 E -04

CUMULATIVE RISK IDENTIFIED FOR CONTAMINANTS FOUND IN SOILS [1]		
EXPOSED INDIVIDUAL	RISK ATTRIBUTEDTO DIOXIN	TOTAL LIFETIME CANCER RISK [3]
Future Worker	5.15 E -05	1.52 E -04
Future Construction Worker	6.71 E -06	9.71 E -06
Future Maintenance Worker	1.10 E -04	2.0 E -04
Future Resident	2.81 E -04	5.81 E -04

FOOTNOTES FOR TABLE 5

* There was no Dioxin ever detected in Creek sediment.

1 As calculated in the document "Ott/Story/Cordova Operable Unit #3 - Final Risk Assessment Technical Memo" dated December, 1992, prepared by Black and Veatch for U.S. EPA and corrected on December 7, 1997.

2 When the Hazard Index (HI) is greater than 1, there is a potential for health problems such as damage to vital organs, birth defects, and anemia and other blood disorders. U.S. EPA and the State of Michigan may perform Remedial Actions if an HI is 1.0 or above.

3 Using a basis of a 70 year life time. A 1.0 E -06 cancer risk value corresponds to a 1 in 1,000,000 chance that an individual develops cancer as a result of exposure to these concentrations of contaminants over a period of 70 years. Similarly, 1.0 E -05 corresponds to a 1 in 100,000 chance, 1.0 E -04, 1 in 10,000, and so on. U.S. EPA may perform a Remedial Action if cancer risks are greater than 1.0 E -04. The State of Michigan is required to take action at a cancer risk of 1.0 E -05 or greater.

4 "Current Resident and Trespasser" presumes exposure for an individual by ingestion and dermal contact with contaminants in Creek bank sediments and Site soils during trespassing events for the current Site conditions. "Future Worker" assumes exposure to Site surface soils during industrial production activity over 8 hours per day (such as chemical production or factory work). "Future Construction Worker" represents an individual exposed to Site surface and subsurface soils for 8 hours per day for one year during construction activity required for capital projects. "Future Maintenance Worker" signifies an individual who would be performing maintenance such as landscaping, building dismantling, and railroad spur upkeep during an average six months per year. "Future Resident" assumes daily exposure to Site soils for an individual living in a residence located on the Site 350 days per year. All scenarios are in accordance with U.S. EPA risk assessment guidance.

TABLE 6 - GROUNDWATER SUMMARY [1] TO DEMONSTRATE EFFECTIVENESS OF GWTF; Ott/Story/Cordova Site

CONTAMINANT	FEDERAL MAXIMUM CONTAMINANT LIMIT (MCL) (ppb)	MI PART 201 RESIDENTIAL GROUNDWATER CLEANUP STD. (ppb)	CONTAMINANT LEVEL CITED IN ROD[2] (1989) (ppb)	HIGHEST CONCENTRATION OF CONTAMINANT INTO GWTF [3] (3/96 to 6/96) (ppb)	CONTAMINANT GOING INTO GWTF (Oct. 2001) (ppb)	GWTF DISCHARGE PERMIT LIMIT (ppb)	CONTAMINANT DISCHARGED OUT OF GWTF (ppb)
Benzene	5	5	3800	1700	360	5	< 1
1,1 - Dichloroethene	7	7	7900	320	15	5	< 1
1,1 - Dichloroethane	N/A	880	6300	390	50	5	< 1
1,2 - Dichloroethane	5	5	110000	3900	280	5	< 1
Tetrachloroethene	5	5	24000	160	94	5	< 1
Toluene	1000	790	38000	1900	400	5	< 1
Vinyl Chloride	2	2	130000	350	58	5	< 1
Benzoic Acid	N/A	32000	1300	220	< 50	5	< 50

FOOTNOTES FOR TABLE 6

1 This is only a limited summary. Contaminants shown are provided only as a comparison against the limited list of groundwater contaminants cited in the site Records of Decision. There were additional contaminants identified after the RODs in groundwater and other media for this site. All values shown are in µg/L or parts per billion (ppb).

2 "ROD" is acronym for Record of Decision.

3 GWTF started up in Feburary 1996. The period from March to June 1996 represents the time when the GWTF had to treat the highest levels of contaminants to date. These levels may increase in future depending on the long term scope of the remedy.

TABLE 7 - CAPITAL COST FOR OTT/STORY/CORDOVA O.U. #2 GROUNDWATER TREATMENT FACILITY (GWTF)

Item	Costs
O.U. #1 Installation of Extraction Wells	$ 524,000
O.U. #2 GWTF Remedial Design	approx. $ 1,600,000
O.U. #2 GWTF Remedial Action (including 1 year of start-up; '96-'97)	$ 28,302,000
O.U. #2 GWTF 1 additional year of shakedown ('97-'98)	$2,600,000
O.U. #2 GWTF 2nd additional year start-up ('98-'99)	$2,600,000
O.U. #2 GWTF 3rd year and new effluent pipe line ('99-'00)	$3,750,000
O.U. #2 Additional Funding	$995,000
O.U. #2 First Year LTRA ('00-'01)	$3,000,000
O.U. #2 Second Year LTRA ('01-'02)	$2,500,000
TOTAL ESTIMATED CAPITAL COST AS OF MARCH 2002	$45,871,000

FOOTNOTES FOR TABLE 7

(1) Table 7 includes all USACE Administration costs and costs from their contractors. Table 7 represents 100 % of capital costs, of which the State of Michigan is responsible for 10% of Remedial Action cost only. U.S. EPA final cost will be 90% of total shown, except for Remedial Design, for which U.S. EPA is responsible for 100 %.

(2) Table 7 does not include payroll costs, indirect costs, travel costs, or contractor costs for U.S. EPA , U.S. Department of Justice, or State of Michigan.

TABLE 8 - ANNUAL O&M COSTS FOR OTT/STORY/CORDOVA O.U. #2 GROUNDWATER TREATMENT FACILITY (GWTF)[1]

#	OPERATIONS ITEM	COMMENT	COST
A	Utilities		$ 360,000
A.1	Electric (includes Extraction Wells)		$ 120,000
A.2	Natural Gas		
A.3	Potable Water/Township Fee	Ann. fee for pot.water usage and fire protection	$ 3,600
B	Labor - Operations Personnel (1 yr.)[2]; not including "Non-Routine" Extraction Well Work	Includes Supervisor, Treatment Process O&M and Lab Staff, and 24 hour "on-call" services; see Footnote (2)	$ 750,000
C	Maintenance; Equipment and Materials[3]	Includes O&M of Equipment and Materials for Treatment Process, Building and Grounds Maintenance, and On-Site Lab Analytical; see Footnote (3)	$ 391,000
D	Lab Analytical (Off-Site) [4]	see Footnote (4)	$ 123,000
E	Powdered Carbon		$ 91,000
F	Granular Activated Carbon		$ 73,000
G	P-255HV GWTP Polymer Usage		$ 11,300
H	Phosphoric Acid[5] (Phosphorus for Treatment Microbes)		$ 11,900
I	Hydrochloric Acid[6] (Filter Press Cleaning)	Contract Allowance (per yr)[6] see Footnote (6)	$ 200
J	Ferric Chloride Usage (Phosphorous Removal)		$ 12,000
K	Sodium Hydroxide Usage [7] (pH Control)	Contract Allowance (per yr)[7] see Footnote (7)	$ 2,900
L	Lime Usage (Sludge Conditioning)	Lime is not used; sludge tested and disposed as non-haz.	$ 0
M	Sludge Disposal (Non-Hazardous)		$ 8,400
N	"Non-Routine" Extraction Well Repair and Preventive Maintenance [8]	Allowance for drill rig, special work, including equipment, material, and labor[8] ; see Footnote (8)	$ 100,000
O	Sulfamic Acid for "Routine" well cleaning [9] LABOR INCLUDED IN ABOVE ITEM N		$ 3,500
P	Acetic Acid for "Routine" well cleaning [9]		$ 52,500
Q	Polymer for well cleaning [9]	Contract Allowance (per yr)[9] see Footnote (9)	$ 7,700
R	Unscheduled Maintenance Allowance	Annual "Contingency" for Unforeseen Repair	$ 120,000
		CORPS OF ENG. CONTRACT ADMIN. COST	$ 208,000
		ESTIMATED GWTF ANNUAL O&M TOTAL COST	$2,450,000

FOOTNOTES FOR TABLE 8

(1) Cost values have been compiled from USACE current contract allowances and is the best available information at this point in time. Estimates contain contingency to insure enough money is budgeted to cover contract costs. Annual O&M costs have decreased as cost reduction and process optimization procedures continue.

(2) This proprietary information has been calculated by the contractor using estimated man-hours and appropriate hourly wages. The detailed calculation can be made available to U.S. EPA if needed, but only upon special request. Labor estimate includes "Routine" extraction well work, such as simple well cleaning, operations monitoring, and support of any independent well repair contractors.

(3) Does not include Labor, which is Item # B. Item #C includes, but is not limited to: snow removal, lawn mowing, landscaping, plant alarm and security service, replacement of on-Site lab consumables, telecommunications services, lab maintenance, air compressor maintenance, trash removal, field office equipment, and consumable safety supplies.

(4) Contract allowance. This will be reduced with continuing optimization of operations.

(5) Phosphoric Acid quantities and costs are derived from "Contract Allowance" value. Frequency of delivery of Phosphoric Acid varies throughout the operational year.

(6) Hydrochloric Acid has not been used extensively for filter press cleaning.

(7) Sodium Hydroxide ("caustic") has not been used extensively since 2/12/96. Value is an allowance as contingency.

(8) Item N is for an independent well contractor. "Non-Routine" extraction well work includes anything that requires an independent contractor, such as work that needs a large well drilling "rig", or complex electrical work or piping.

(9) "Routine" extraction well work includes simple well cleaning (introduction of cleaning chemicals into well), operations monitoring, support of any independent well repair contractors, replacement of extraction well pumps, and any other tasks which can be performed by available on-Site personnel and equipment.

TABLE 9 - O&M COST* ESTIMATE FOR OTT/STORY/CORDOVA O.U. #3 REMEDY

ITEM	UNIT COSTS	TOTAL COST / YEAR
Periodic Inspection of Excavated / Filled Areas [1]	$ 1,280 / event (2 events per year)	$ 2,560
Maintenance of Fence and Signage [2]	$ 1,120 / event (1 event per year)	$ 1,120
Little Bear Creek Quarterly Monitoring (Surface Water / Sediment Sampling and Analysis) [3]	$ 20,000 (every 3 months - 4 times per year total)	$ 80,000
Sub-Total		$ 83,680
CONTINGENCY (20%)		$ 16,736
TOTAL		$ 100,416

* O&M for O.U. #3 will be implemented by State of Michigan. The estimates shown here provide an indication of costs in the event these tasks become necessary in the future. It is anticipated: that the O.U.#3 remedy will not need to operate longer than 30 years; that there should not be extensive sampling and analysis of O.U. #3 plant area soils; and that there should not be extensive site security required for O.U. #3. The main O&M task for O.U. #3 is sampling and analysis of the Little Bear Creek system. Groundwater monitoring and site security are generally handed within the scope of operation and maintenance of the O.U. #2 remedy.

1 Estimated by U.S. EPA as : $ 80 /hr per person x 8 hrs x 2 people = $ 1,280 (including travel and other misc. costs)

2 Estimated by U.S. EPA as : $ 70 / hr per person x 8 hours x 2 people = $ 1,120 (local fencing crew - 2 people)

3 Estimate calculated by U.S. EPA contractor.

TABLE 10 - PRESENT WORTH CALCULATION FOR OTT/STORY/CORDOVA O.U. #3 REMEDY

TIME PERIOD FOR PRESENT WORTH ANALYSIS	30 years	100 years
DISCOUNT RATE FOR PW	5 %	5 %
P/A FACTOR (See Table 8A)	15.37	19.85
Annual O&M Costs	$ 100,416	$ 100,416
PRESENT WORTH OF O&M	$ 1,543,394	$ 1,993,258
NET PRESENT WORTH ** (INCLUDING CAPITAL COST)	$ 4,343,394	$ 4,793,258

** Capital cost for O.U. #3 soil remedy was approximately $2,800,000 (implemented by MDEQ).

TABLE 11 - APPROXIMATE SCHEDULE FOR FIVE YEAR REVIEW RECOMMENDATIONS

Task	Estimated Completion	Responsible Organization
Transfer of site property*	12/30/2002	Site Property Owner
Deed Restriction*	12/30/2002	Site Property Owner
Detailed Assessment of O.U. #1 / O.U. #2 Remedy (inc. more definitive time estimate to reach cleanup standards)	3/30/2003	U.S. EPA / BV
ROD Amendment or ESD	12/30/2003	U.S. EPA
Five Year Review / Remedy Assessment (continues every 5 years until cleanup goals have been achieved)	9/30/2007	U.S. EPA
Long Term Response Action**	9/30/2010	U.S. EPA / MDEQ
Five Year Review / Remedy Assessment	9/30/2012	U.S. EPA / MDEQ
Five Year Review / Remedy Assessment	9/30/2017	U.S. EPA / MDEQ
Five Year Review / Remedy Assessment	9/30/2022	U.S. EPA / MDEQ
Five Year Review / Remedy Assessment	9/30/2027	U.S. EPA / MDEQ
GWTF Operations***	9/30/2030	MDEQ
O&M for O.U. #3***	6/30/2032	MDEQ
Site Operation and Maintenance****	9/30/2130	MDEQ

* Estimated; exact dates to be determined by Muskegon County.

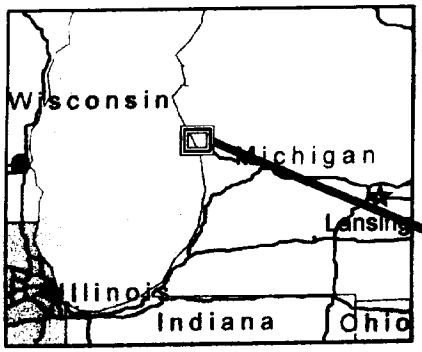
** For 10 years (2010), LTRA cost is divided into a 90 percent Federal and 10 percent State share, after which the State assumes 100 percent of remedy cost.

*** Currently based on a 30 year project time. This project time is being re-assessed using groundwater computer models and are dependent on any revisions to cleanup standards. The trigger date for completion of O.U. #3 O&M is the Spring 2002 certification of completion. Extensive O&M tasks are not anticipated for O.U. #3.

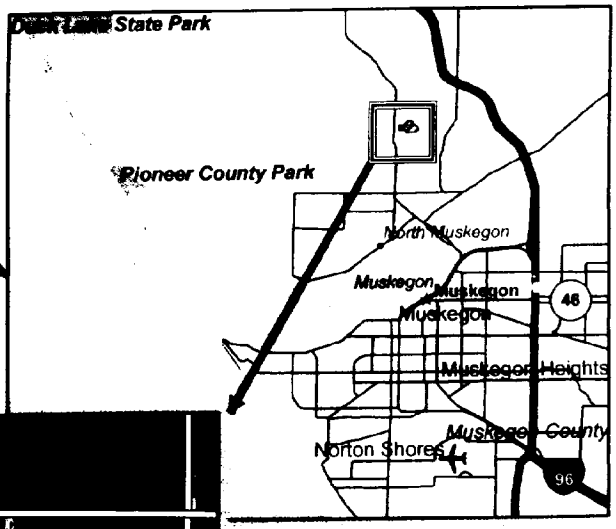
**** GWTF operations end when cleanup standards are reached, at which point "O&M" starts (O&M may be general housekeeping or other minimal caretaking activity for the property)

Ott Story Cordova Superfund Site
Muskegon County, Michigan

1) State



2) City of Muskegon



3) Ott Story Cordova Superfund Site

Plot created by David Wilson U.S. EPA Region 5 on 9/11/2002
Color Infra-Red Image Date: 5/4/1997

Figure 1

Ott Story Superfund Site
3D Surface Terrain Model

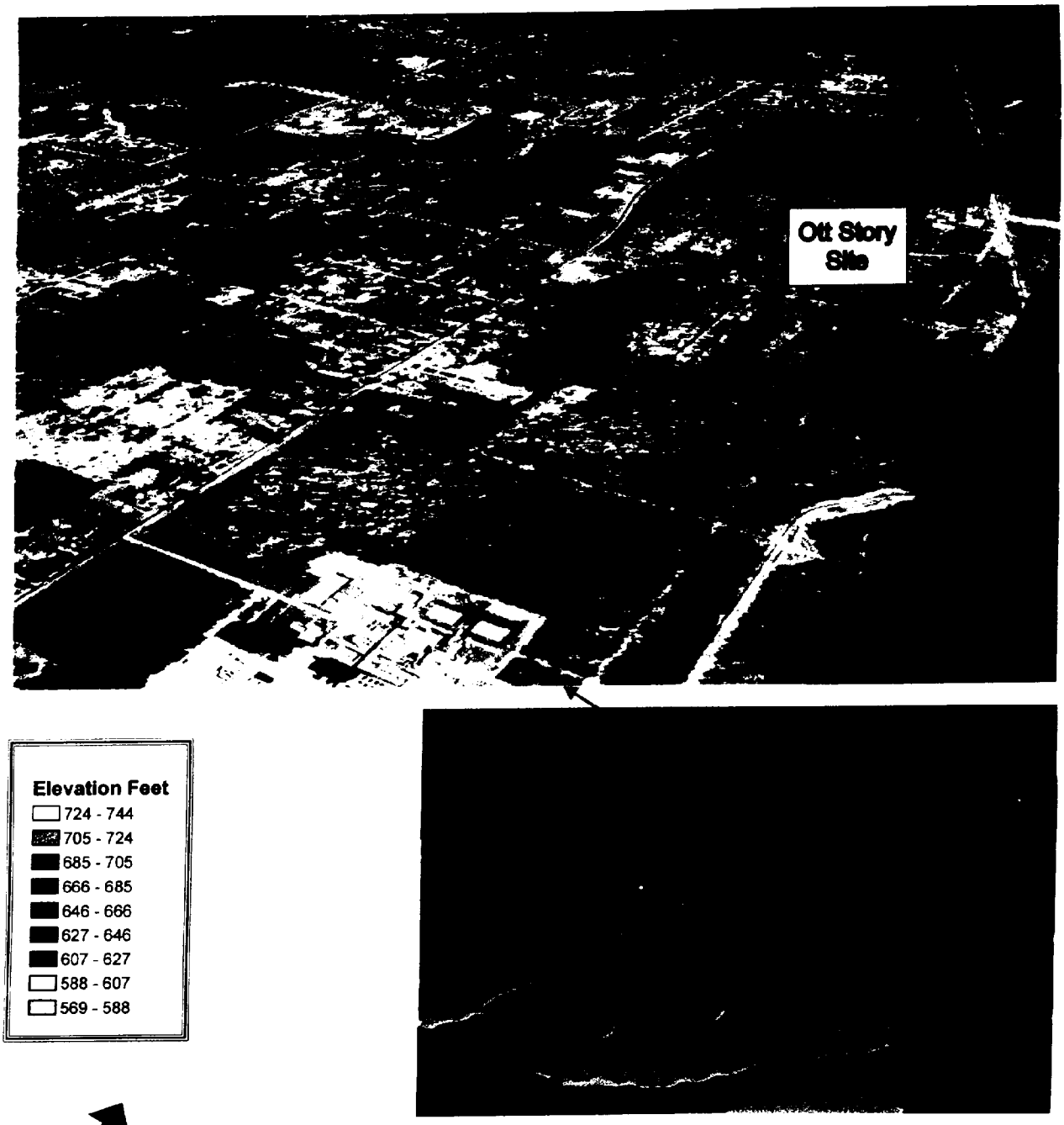


Figure 2

Plot created by David Wilson U.S. EPA Region 5 on 9/11/2002
Color Infra-Red Image Date: 5/4/1997

EPA

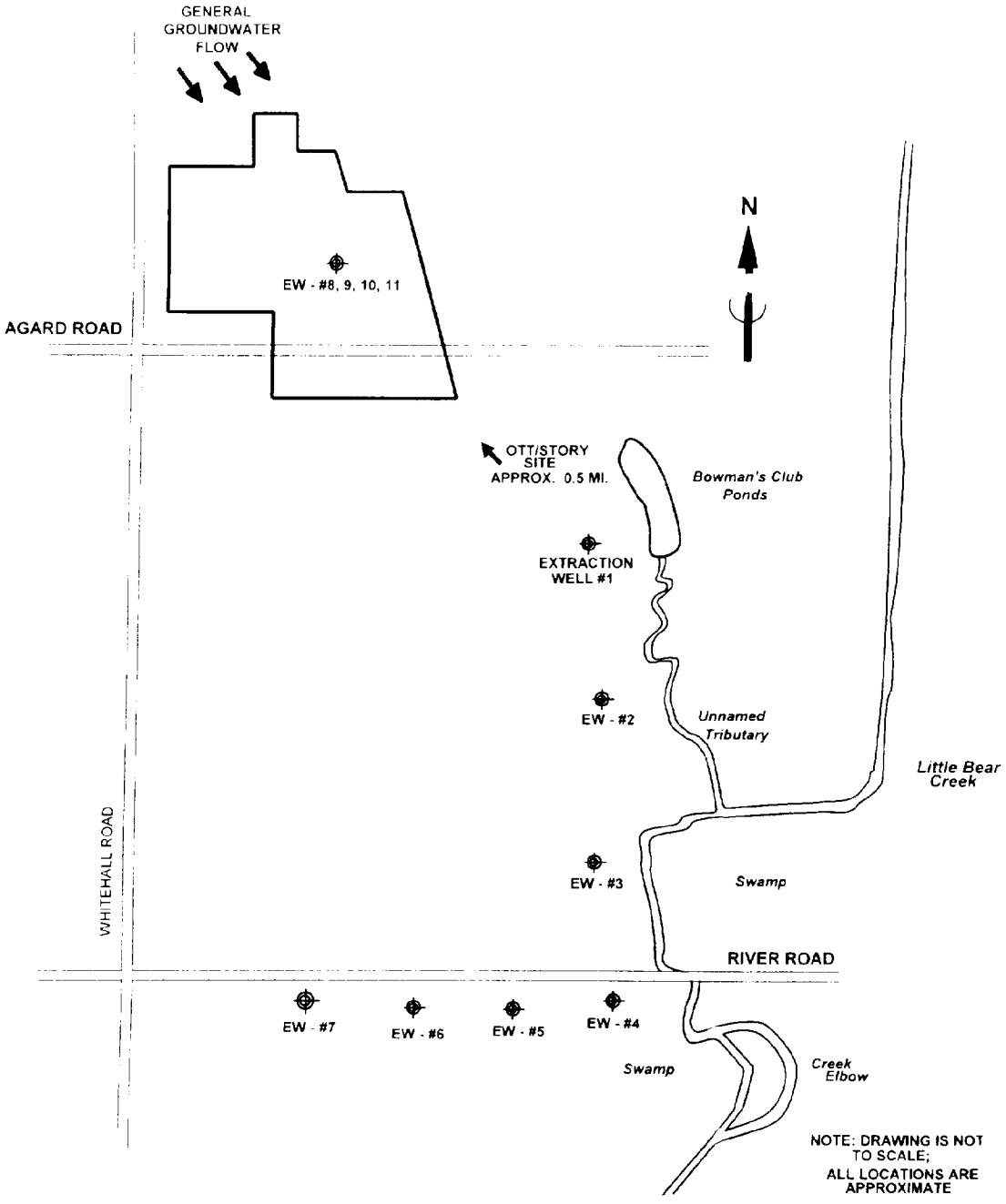


FIGURE 3 - OTT/STORY/CORDOVA SUPERFUND SITE LAYOUT

NOTES:

1. DRAWING NOT TO SCALE
2. ALL EXCAVATION AREAS APPROXIMATE

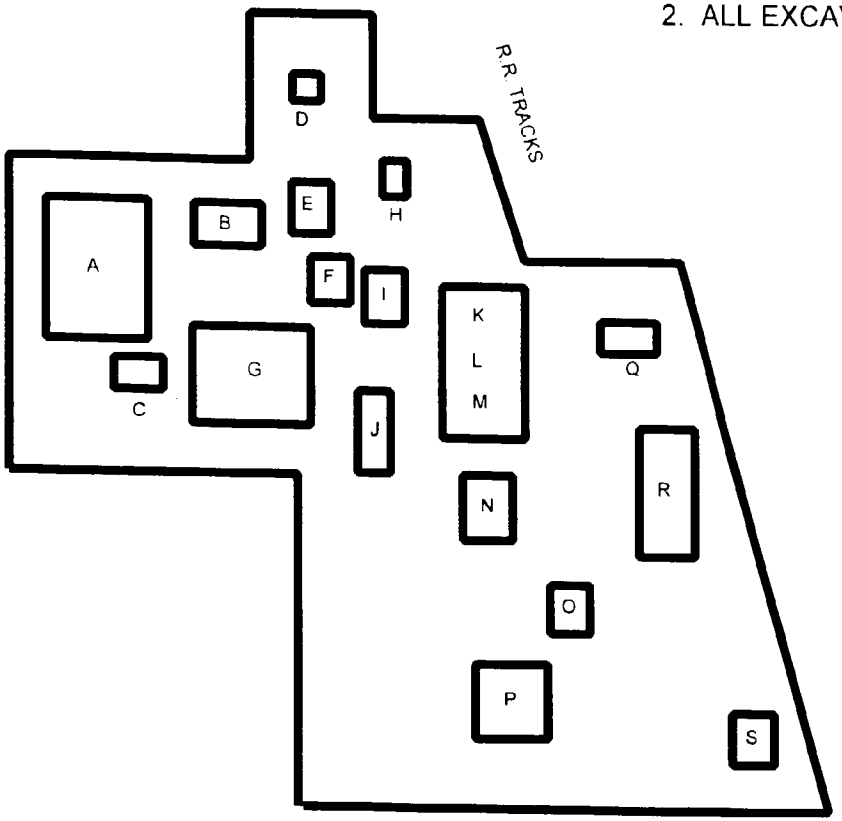


FIGURE 4 - PROPOSED O.U. #3 LTTD REMEDY EXCAVATION AREAS

NOTES:

1. DRAWING NOT TO SCALE
2. ALL EXCAVATION AREAS APPROXIMATE

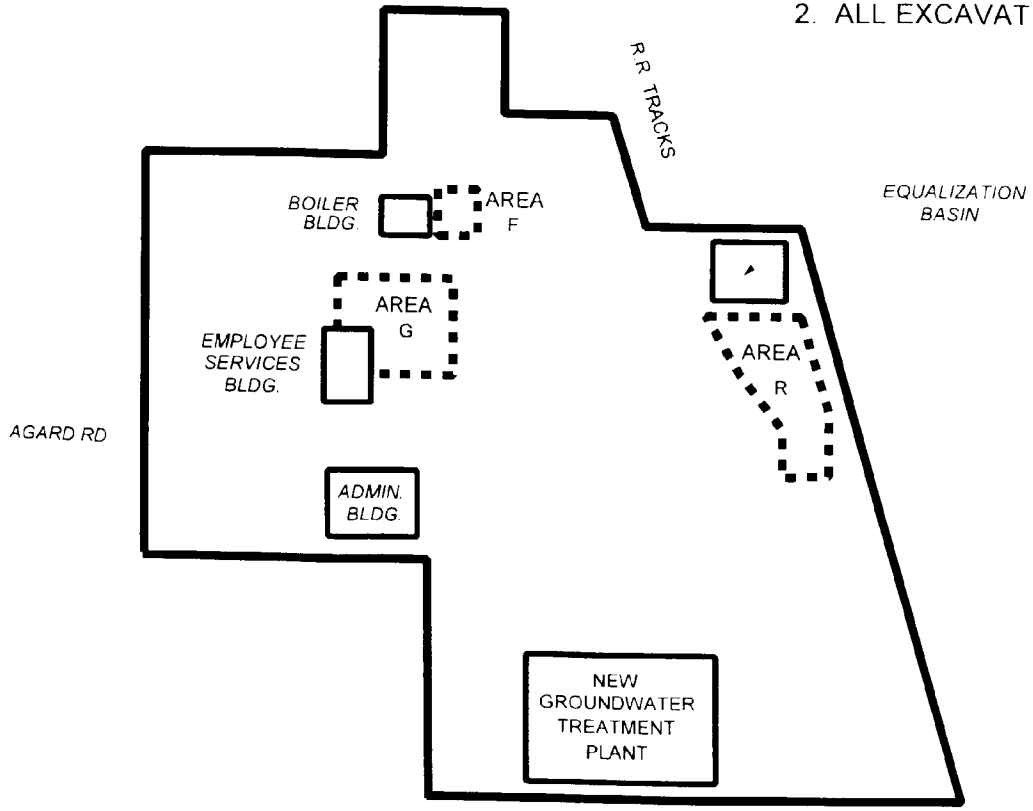


FIGURE 5 - EXCAVATION AREAS FOR REVISED O.U. #3 REMEDY